THE THYROID GLAND AND ENLARGEMENT OF THE THYROID, OR GOITRE

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Commission of Conservation
Canada

COMMISSION OF CONSERVATION
CANADA

GOITRE

Its Incidence, Course, Causation, Prophylaxis and Treatment

Some Remarks on the Anatomy and Physiology of the Thyroid Gland and on Enlargement of the Thyroid, usually called Goitre

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Commission of Conservation

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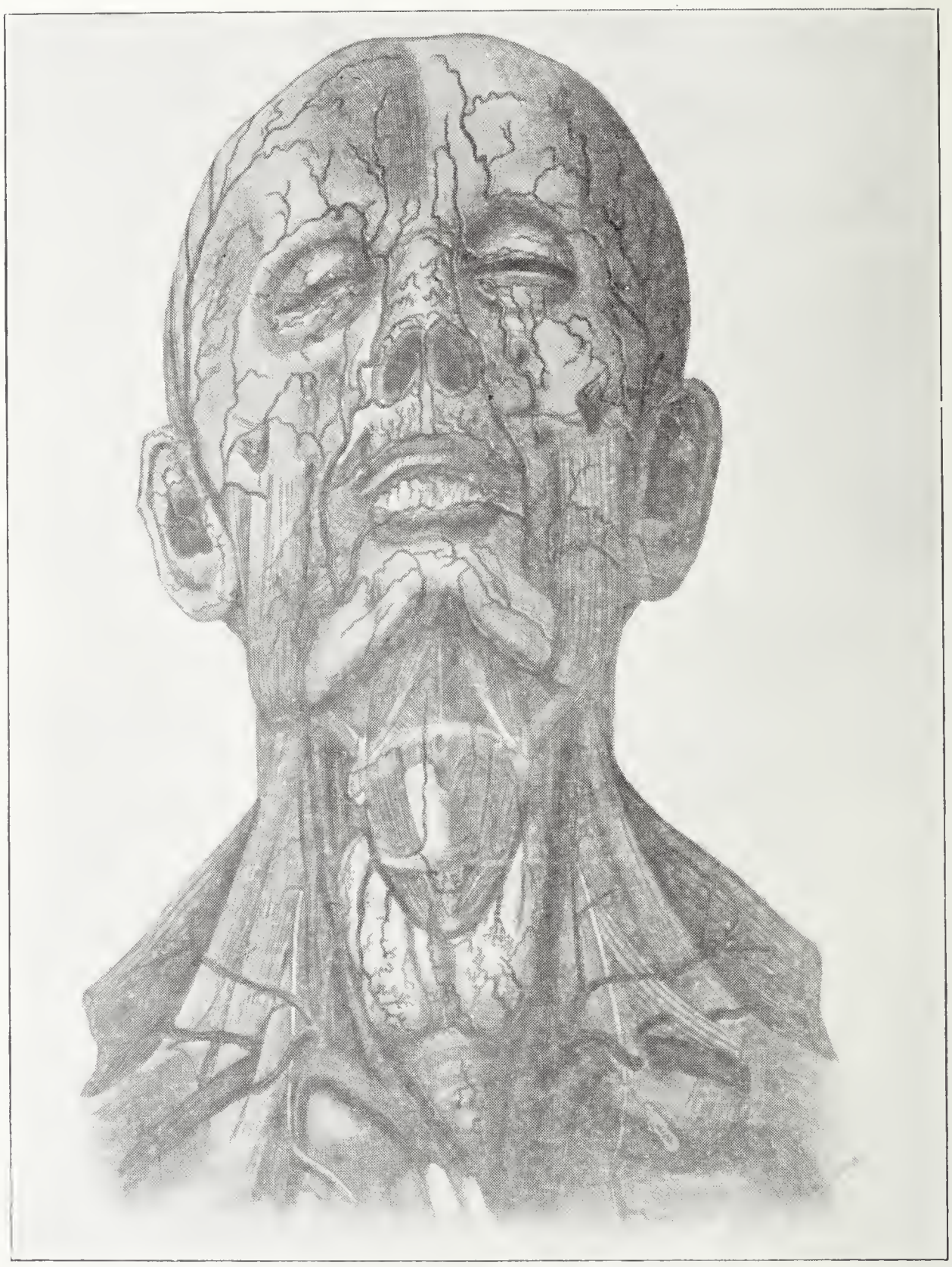

Fig. 1.—Dissection of the neck, shewing the thyroid gland and windpipe.

FOREWORD

IN 1917, Mr. John F. Sweeting, Industrial Agent, Canadian Pacific Ry., Calgary, transmitted to the Commission of Conservation a memorandum by Dr. T. G. Ritchie, Cochrane, Alta. Dr. Ritchie claimed that goitre was alarmingly prevalent in Alberta. He said that, in August, 1916, he stood on 8th Avenue, Calgary, "with a gentleman, for three-quarters of an hour, during the lunch time, checking off the distinguishable cases passing, and we estimated that at least 50 per cent of the women we saw, whose necks were exposed, showed distinct goitres, and these were mostly working girls and the prospective mothers of the next generation."

Dr. Ritchie also stated that a Calgary physician had informed him "that about 15 per cent of the students attending the Calgary Normal Schools are victims of goitre, although most of them have only been a short time resident of the province. . . . It is our duty to prohibit the ingress of settlers into the west until at least we initiate active measures with a view toward controlling the disease."

This correspondence was submitted to Dr. T. J. Norman, Provincial Medical Officer of Health for Alberta, *pro tem.*, with a request that he would favour the Commission with his views.

Dr. Norman, in his reply, said: "I cannot consider this a particularly virulent disease, as virulence in my mind is connected with fatality, while in 1915-1916, no cases died from ordinary goitre. In 1915, eight cases died of exophthalmic goitre and, in 1916, nine died of the same disease. I believe most physicians consider this quite separate and distinct from the ordinary goitre about which Dr. Ritchie is writing, so that, for that variety, there have been no deaths.

"When one compares this with the fatality from tuberculosis of 265 in 1915 and 297 in 1916, and, again, 312 deaths in 1915 from pneumonia (bronchial and lobar) and 453 in 1916, and, with these two diseases proving fatal at this rate, most certainly they are the diseases that should be first taken up and combated, for goitre, at the most, is only a disfiguring disease. Also, it is a world-wide trouble, and, in certain districts, it is probably more prevalent than in others; but we get the benefit of all investigations the world over without the expenditure of money, inasmuch as the cause is the same in all places.

"At one time, I believe, the water was blamed, then, I think, there was a revulsion of sentiment against that; but, as to the actual statistics of to-day, I am not so conversant. However, I think these diseases should be more judged by fatality than any other way. Also, the other provinces in Canada have just as much goitre and perhaps more than Alberta as a whole, but this district of Cochrane may be particularly troubled with this disease, and, if investigated at all, it should be a Dominion-wide investigation, not only for Alberta but for all the provinces.

"A great deal of money has been spent on investigation in Europe, especially in Switzerland and England, and in the United States, and

why we should spend money on goitre when there are more pressing problems, I cannot just see; especially as it is not a local trouble, and it is one where we are getting the benefit of world-wide investigation without spending money.

"In the Ontario district whence I came, there were certainly no mountains, and, yet, in that little district, there was probably as much goitre as in any similar area in Alberta. In fact, I have seen much more goitre in Ontario than I have in Alberta.

"Of course, if the Commission of Conservation or the Dominion took it up and really succeeded in finding the cause of the trouble, and in finding also a remedy, it would be quite a noted feat on their part. On page 2 of *Goitre in Alberta*, Dr. Ritchie says that thousands of people of untainted blood have settled here and are rapidly falling victims to the disease. The question is: 'When the doctor admits that these cases take twenty to thirty years to develop, how does he know that the sufferer's blood was untainted when he settled here, or whether it was really in the system, and whether any infection—if you could call it such—did arise in Alberta?"

"If this disease were of the importance attached to it by Dr. Ritchie—and we do not contend it is unimportant—since the women of the country are the ones it probably attacks the most and in which the swelling in the neck shows the most, one would think that they would be petitioning, through their Women's Councils, to have this trouble investigated and, if possible, eliminated; but, as far as I know, none of them have mentioned anything of this nature, but they are most strenuously mentioning such diseases as tuberculosis, which is rendering unfit for service so many in the province.

"Because goitre develops in British Columbia and in Alberta in cases where it had not developed prior to coming here, does not, in my opinion, prove that they would not have had it had they remained where they were."

Dr. T. H. Whitelaw, Medical Officer of Health for Edmonton, Alta., wrote as follows:

"After a residence of 19 years in Edmonton, during the first 10 years of which I was in general practice, afterwards filling the position of Medical Officer of Health for the city, I cannot say, in so far as this district is concerned, I can see any justification whatever for Dr. Ritchie's sweeping statement regarding goitre. It is apparent that, 10 years ago, a great majority of the adults then living in the Province of Alberta had not been born in the province, but had migrated from other parts of the world; even at the present time, I think it would be reasonable to say that the majority of the inhabitants of our province were not born here. I am personally acquainted with a great many 'old-timers' and their families, who were here when I came here 19 years ago, and I cannot say that I recollect seeing a single case of goitre among them. It would be interesting to know how many of the genuine cases of goitre in Alberta are native-born Albertans. There are, it is true, a certain number of cases of goitre here, but not, in my opinion, any more than there are in other parts of Canada. As to Dr. Ritchie's statement of the large number of cases in Calgary, I question very strongly whether he has

the ability to make an accurate diagnosis of goitre by simply observing the necks of women as they pass him standing on a street corner. He is certainly a very expert diagnostician if he can diagnose, properly, real cases of goitre in so simple a manner. Personally, I believe that the great majority of women, quite naturally, have a larger development of the thyroid gland than men, and that, owing to the more flaccid condition of the muscles of the neck, the thyroid gland is liable to stand out more prominently in their sex."

Following this correspondence, Mr. James White, Assistant to the Chairman, Commission of Conservation, made enquiries at Regina, Calgary and Edmonton, in the summer of 1917. The information thus obtained indicated that many people in Alberta were much alarmed respecting the prevalence of this disease and believed that it was increasing at a dangerous rate. The Local Council of Women, Calgary, had passed a resolution "That, in view of the increasing prevalence of goitre, not only in Alberta but elsewhere, the Commission of Conservation be asked to investigate its cause." Requests to the same effect were also received from individuals.

As a result, the Alberta Provincial Board of Health were requested to state whether, in view of the agitation respecting goitre in their province, they desired that the Commission of Conservation investigate the question.

Dr. T. J. Norman, Provincial Medical Officer of Health, replied: "The Board are of the opinion that goitre is not more prevalent in Alberta than in at least most of the other Canadian provinces, nor, in their opinion, is it more likely to have its origin in this province than in others. Nevertheless, the Board would welcome any assistance your Commission could give, in the way of *determining the cause* of the disease and the means that ought to be adopted to prevent its spreading.

"A mere tabulation of its prevalence would, in the opinion of the Board, be only a very small and, probably, misleading feature of any investigation of this matter.

"If the Commission decide on conducting an investigation into the matter of goitre, in all the provinces in Canada, the Provincial Board of Health desire that Alberta be included in that investigation."

The Commission of Conservation, however, was not prepared to undertake an exhaustive investigation of goitre throughout the whole of Canada. Neither investigators nor funds were available and, in addition, the evidence adduced respecting the effects of goitre, as compared with the mortality due to tuberculosis, pneumonia, etc., did not indicate that the expenditure of this money could be justified by the results obtained.

On September 29, 1917, the Alberta Medical Association passed the following resolution:

"Whereas statements have appeared in the press of Alberta from time to time giving the impression that goitre is extremely prevalent in the province.

"And inasmuch as the statement has been made by certain members of the profession that from 50 to 100 per cent of the population is affected by goitre.

"We, the members of the Alberta Medical Association, representing all the urban and rural districts of Alberta, desire to place ourselves on record as being of the opinion that goitre is not any more prevalent in Alberta than in other parts of Canada.

"We desire, further, to state that, in our opinion, there is absolutely no reason for anxiety regarding the spread of the disease. Further, that we place ourselves on record as disagreeing absolutely with the statements made by Dr. Ritchie in his paper regarding the prevalence of goitre."

During the winter of 1917-18, the Women's Institutes of British Columbia passed a resolution requesting the Government to enquire into the prevalence and cause of goitre among school children. It was also evident that the people of Alberta and British Columbia were becoming more alarmed and that the "scare," instead of decreasing, was increasing.

In February, 1918, the Commission of Conservation communicated with Dr. F. J. Shepherd, late Dean of the Faculty of Medicine, McGill University, Montreal, and one of the highest authorities in the Dominion, respecting goitre in Canada. As a result of the negotiations, Dr. Shepherd agreed to undertake the investigation, but declined to accept any remuneration other than his travelling expenses. It is only proper that the Commission of Conservation should express the gratitude of its members and of the people of Alberta for Dr. Shepherd's altruism in undertaking this work when he already had his time fully occupied with his work in connection with the Hospitals Commission. Owing to the demands upon his time in connection with this war work, Dr. Shepherd was unable to go to the West until early in May, 1918.

On his return, Dr. Shepherd submitted the following report:

"I arrived in Calgary on the morning of May 13th and went that morning with Mr. Sweeting to Cochrane to see Dr. Ritchie and investigate as to the frequency of goitre there.

"He showed me a number of cases of goitre, chiefly of the diffuse form, and in girls from 14 to 18 years of age: many in adults also. I examined the girls over 13 in the school and found 4 out of 14 with the disease. Owing to lack of time many cases could not be shown me, but I saw enough to draw the conclusion that goitre was very prevalent in Cochrane.

"Dr. Ritchie has rather alarmed the people by his letters to the papers and personal conversations with various ladies, in which he predicted a degenerate race if steps were not immediately taken to arrest the spread of goitre. He has no very definite ideas as to what should be done. I told him there was no doubt that goitre was very prevalent there, but his deductions were all wrong and that his theories he treated as facts. I also advised him to talk less, especially about matters which were purely theoretical. Dr. Ritchie could show me no case of cretinism. All the women suffering from goitre told me that the disease was very common and that they knew of many cases.

"On May 14th, I saw the Mayor of Calgary, Dr. Costello, and had a long talk with him. I told him the prevalence of goitre was a question of water, and assured him that pure water would reduce the amount

of goitre very considerably. I am told that, at times of freshets (June), the Calgary water is very thick and dirty and is not drinkable and it is difficult to wash with it. When I was there it was pure and clear. The Mayor told me they were building a filtration plant, but want of money had prevented its completion.

"In the afternoon, I met the Health Committee of the Local Council of Women, presided over by Mrs. Edwards. The meeting lasted some time and many questions came up and were discussed. The great majority of the Committee agreed that goitre was very prevalent in Calgary, and they seemed much disturbed about it. Dr. Oakley, a lady practitioner, and the Medical Inspector for the schools, reported at the meeting that 25 per cent of the girls in the high school had goitre; a very small percentage occurred in the male pupils. Of course, the statistics of the high school, where older pupils attended, are most important, as goitre rarely attacks young children. Among 1,200 pupils of all ages there were 56 cases of goitre, so there is no doubt goitre is prevalent in this region.

"I assured the ladies that, beyond the deformity induced by it, they need fear no ill effects as predicted by some; that, for generations in the Province of Quebec (*c. g.*, Three Rivers), goitre has been prevalent, and yet the people had not deteriorated. I also told them that the disease was due to an infection, most probably by an intestinal bacillus, some authorities attributing it to the *Bacillus Coli*; that the infection was no doubt conveyed through water, and that boiling the water would greatly lessen, if not wholly prevent, the disease. Also, if those already affected were treated with iodine internally and iodine ointment externally, and if, at the same time, all the water used for tea, coffee, and for drinking was boiled, the goitre, not being subject to fresh infection, would be reduced in size and would probably disappear.

"They seemed satisfied with the results of the interview, but still thought the Federal Government should intervene and insist on pure water. I, however, told them that this was a provincial matter, and they should appeal to their own Legislature.

"From what I could gather, the authorities do not wish it to be known that goitre is prevalent, and so do not discuss it, fearing that open discussion might interfere with the prosperity of the country. Of course, in many other parts of Canada goitre is prevalent, where there is little earth covering the rock, as at Sudbury and Byng Inlet, Ont., etc. In such places, the earth is not sufficient to disinfect the water passing through it. It is now well established that ordinary goitre (not exophthalmic) is caused by infected water, that is, it is caused by water infected with the excreta of man or animals suffering from goitre. Whether the organism is a specific bacillus or not, or whether it is due to the *Baccillus Coli*, is a vexed question. Animals are very subject to goitre, and it is common in dogs, horses, calves, sheep, etc. As these animal graze on the hills, their excreta would, in times of freshets, be washed into wells and rivers and thus contaminate them. Boiling the water is the most efficacious way of purifying it. Of course such chemicals as chloride of lime and filtration plants, etc., may be as good but not so easy to carry out.

"I hope my visit to Calgary did some good in quieting the alarms of the people and in discounting to some extent the statements of Dr. Ritchie and others".

Copies of this report were supplied to interested persons and to all who asked for it. In addition, it was printed in the Calgary daily papers.

Following publication in the Calgary papers, Mr. A. N. Mouat, Comptroller-General of British Columbia, drew the attention of the Commission to a reference in the report of the Palliser expedition to the occurrence of goitre 60 years ago, in what is now the province of Alberta. Dr. James Hector, geologist to the expedition, writing at Fort Edmonton, February 6, 1858, says: "Goitre is very prevalent among the residents here and at the Rocky Mountain House,* but in a modified form, and I have only seen one case where there is any approach to cretinism. I tabulated the results of 50 or 60 cases, but have not discovered any one complaint. The only curious feature seems to be that children born at one fort are never attacked till removed to the other, and it again disappears on their return to their native place."†

During the summer and autumn of 1918, however, it became evident that a certain amount of uneasiness still existed in Alberta and British Columbia, particularly the latter province. Dr. F. J. Shepherd very kindly offered to contribute the material for a small pamphlet which would calm public opinion by a clear-cut statement respecting goitre, its causes, occurrence, etc. This contribution is presented herewith.

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* Fort Edmonton (present city of Edmonton) was founded in 1795. Rocky Mountain House is on the North Saskatchewan river, 105 miles southwest of Edmonton. It was founded in 1802, on or near the site of a post built by Pangman in 1700.

† *Further Papers Relative to the Exploration by the Expedition under Captain Palliser of.....portion of British North America, p.* 78, Parliamentary Papers, 1860.

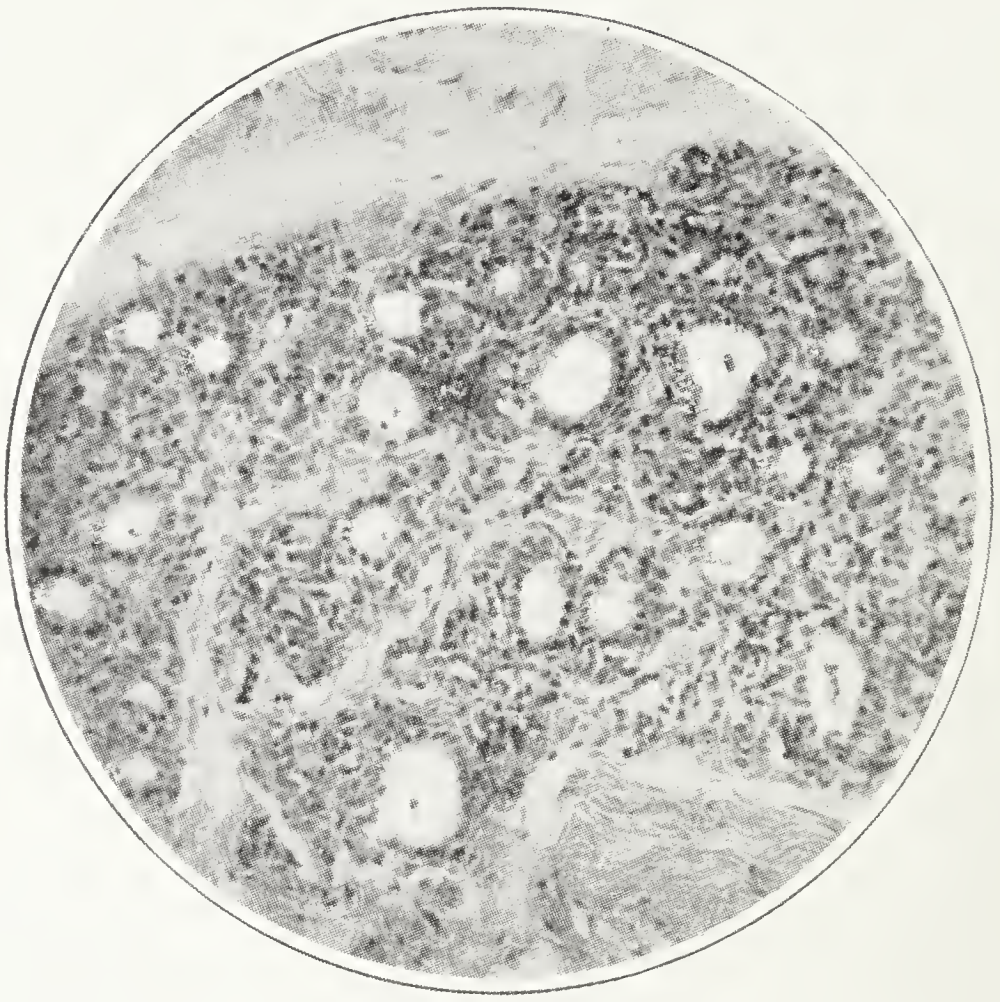

Fig. 2.—Section of normal infantile thyroid gland ; magnified 1000 diameters.

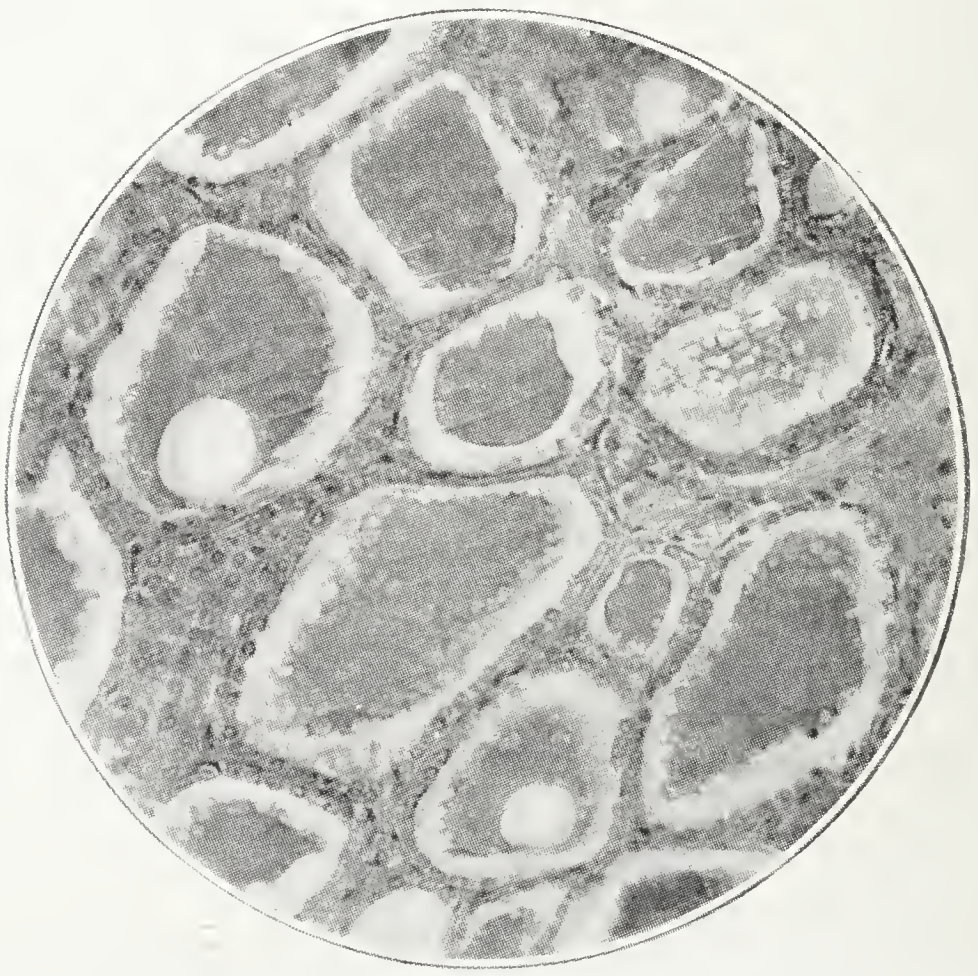

Fig. 3.—Section of normal adult thyroid gland, shewing vesicles filled with colloid ; magnified 1,000 diameters.

Some remarks on the Anatomy and Physiology of the Thyroid Gland and on Enlargement of the Thyroid, usually called "Goitre": Its Incidence, Course, Causation, Prophylaxis and Treatment

BY

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ANATOMY

THE thyroid gland, the enlargement of which is called Goitre, is a very vascular, dusky brownish body which embraces the upper part of the wind-pipe and extends up on each side of the thyroid cartilage (Adam's apple). It is composed of two lateral lobes united by a transverse portion, or isthmus. Externally, it is rounded and covered by a strong sheath of fascia* from the neck; it is also covered by the numerous muscles which extend from the tongue bone (hyoid) to the thyroid cartilage (Adam's apple), and thence to the breast bone; its deep surface is concave and fits about the wind-pipe. Each lateral lobe in its posterior border touches the gullet and envelops the carotid artery, and is in close proximity to the jugular vein. (*See* Fig. 1.) The weight of a normal thyroid gland is about one ounce, but the organ is relatively larger in the female and child than in the male. The gland is richly supplied with blood by four large arteries (the superior and inferior thyroid), two on each side, one above and one below. It is also well supplied with nerves from the sympathetic system which accompany the blood vessels. The gland is composed of a number of cells or vesicles, which are closed and of various shapes and sizes and filled with a glairy fluid of a yellowish colour (colloid), which escapes when the gland is cut. (*See* Fig. 2.) The gland is covered with a thin tissue, which is called connective tissue, and dips down into the gland, dividing it into lobules of various shapes and sizes. The vesicles in young children contain little colloid matter; they are filled with cells of the epithelial type, and colloid matter does not develop until later. (*See* Fig. 3.)

PHYSIOLOGY

The *function* of the thyroid is rather obscure, but it no doubt has an immense influence on metabolism.† The colloid matter in the vesicles of the gland has, except in the very young, iodine always present in it.

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* Thin sinewy covering.

† The change of food substances into elements that can be incorporated into the blood.

The amount of iodine varies in different individuals and under different circumstances, more at the seaside than in high altitudes. Of course iodine exists in other parts of the body but in no other organ in the adult in such quantities. Meat diet tends to lessen the iodine and milk and vegetables tend to increase it. Female animals have more thyroid gland, and, hence, more iodine, per unit of body weight, than males. So far as we know at present the function of the gland is to govern the growth of cells and sustain their functional activity. It is a great stimulant in breaking down used-up cells and governing the elimination of waste products. The thyroid also controls calcium (lime) metabolism. It has an antitoxic and immunizing action and it is supposed to protect the body against invasion of disease-producing germs and injury of their products. By its action in maintaining the nutrition of all body cells it regulates the production of protective substances and maintains the defensive mechanism of the body. By its metabolic activities it regulates the intake of oxygen and the output of carbon dioxide and maintains the constituents of the blood at a proper level. It also regulates the body temperature. McCarrison says: "The thyroid gland is to the human body what the draught is to the fire; nay, more, its iodine, by its chemical interaction with certain unknown constituents of the cells, is the match which kindles it."

Suppression of the function of the thyroid, or the total removal of the gland, produces a state called *myxœdema*, or if a child is born with deficient thyroid, *cretinism*. Thus, in the latter case the development of the sex organs is suppressed when normally the gland stimulates their growth. Skeletal growth is also influenced by the thyroid, hence cretins are undeveloped, puny and stunted. The symptoms of lack of thyroid in the adult are interesting—all metabolic changes are incomplete, nutrition is impaired, the patient is dull, stupid, wants to sleep much of the time, the hair falls out and is very harsh, and there is little expression owing to the obliteration of the lines of the face. The skin becomes swollen, inelastic, dry and harsh, the weight of the body increases, the features become coarse, the nose and lips being larger than usual, and there are twitchings, tremors and spasms in some cases. (*See* Fig. 4.)

When there is an excess of thyroid the symptoms are quite different, metabolism is increased and more urea, phosphates and chlorides are eliminated in the excretions. The patient gets thinner, is sleepless, excitable and irritable and the heart beats at an excessive rate. This condition is well seen in *Graves' disease* or *Exophthalmic goitre*. (*See* Fig. 5.)

As has been before remarked, the efficient development of the sex organs, and the stimulus to mental and physical growth which they in their turn provide, is dependent on the functional perfection of the thyroid (McCarrison). (*See* Fig. 6). At the period of puberty and during menstruation and pregnancy the gland enlarges, and atrophies after the menopause or change of life. In old age there is marked atrophy of the thyroid, and some have held that this has some influence on senility.

In individuals with a slightly deficient amount of thyroid metabolism is much less active, and they resist disease less readily. This

Fig. 4.—Myxoedema due to deficiency of thyroid tissue.

Fig. 5.—Exophthalmic goître (Grave's Disease), due to excess of thyroid tissue.

condition in females, it is said, leads to sterility, which is overcome by treatment by thyroid extract.

Other Ductless Glands

There are many other ductless glands which seem to be more or less interdependent, the *Pituitary* gland, situated at the base of the brain, has a vicarious action with the thyroid, and enlarges when the thyroid is removed. The *Parathyroids* are small glands, four or five in number, situated close to the thyroid. They probably belong to the thyroid apparatus and have identical functions, though many authorities say not. It is said that, when they are completely removed, as is sometimes the case in operations on the thyroid, that tetany occurs. This is a spasmodic affection of the muscles of the body and limbs. The *Thymus* gland is situated in the upper part of the chest, and is frequently enlarged in disease of the thyroid, especially Graves' disease. It is large in children but gradually disappears and is a mere vestige in adult life.

The *Suprarenals* are closely attached to the upper pole of each kidney. These are very intimately associated with the thyroid, the one stimulating the other, controlling the blood pressure and also the supply of phosphorus which the nerves and other systems require during development.

THYROID ENLARGEMENT (GOITRE)

Causes

Many are the causes of enlarged thyroid; such as deficient nutrition, unsanitary surroundings, infectious diseases, heredity, psychic causes (such as fright, worry, grief, etc.), and, most of all, the toxic causes from bacterial organisms which inhabit the intestines. The chief of these is the *Bacillus Coli* and its variants. The dosage of the toxin is important, for small doses over long periods stimulate the gland's activity and induce enlargement. The same may be said of the toxins derived from intestinal parasites (Bedson), such as worms. These toxins from worms also affect the suprarenals (adrenals). These continued small doses of toxins, while doing little harm to a robust individual, may produce serious consequences in the ill-nourished; hence the importance of proper food containing iodine. In Michigan, it is said, the farmers suffered severely in deaths amongst lambs from cretinism, and this was put a stop to by adding iodine to their food. In Wisconsin, in goitrous districts, hairless pigs are born. They correspond to human cretins. Good results have been obtained by feeding the sows whilst pregnant with food which has in it one third of a pound of iodide of potassium to every 100 pounds. Some assert that this treatment altogether prevents the occurrence of hairless pigs.

Lack of oxygen produces also changes in the thyroid gland, hence the importance of fresh air and good sanitation. Intestinal and other forms of indigestion predispose to the derangement of the thyroid, and, therefore, intestinal antiseptics are called for. Blocking up of the intestines (intestinal stasis) is another cause, consequently free movement of the bowels is necessary. A too large meat diet tends to produce harmful intestinal organisms, hence the necessity of using more vege-

tables and milk. Infectious diseases of all kinds have a harmful influence on the gland, and, though the condition induced may not be permanent, they predispose to changes, which in some cases, are permanent.

The conditions above described may not always lead to enlargement of the thyroid and diminution of its colloid contents; a condition of fibrosis, or the changing of the structure of the gland into hard fibrous tissue, may ensue, which is quite as efficacious in destroying the utility of the gland. In these cases the gland, instead of being larger, is smaller and harder. (*See* Fig. 7.)

Endemic Goitre

By endemic goitre one means the existence of goitre in certain circumscribed areas. This form of goitre is usually not accompanied by any marked disturbances of function. Endemic goitre pervades the whole world; no country is exempt. It is said to be most prevalent in subtropical and temperate zones, but great heat or great cold does not prevent its occurrence. It is seen in Finland, Siberia, the Canadian Northwest, the Hudson Bay district, as well as in India, Java and Ceylon. It is common in many parts of Canada, from New Brunswick to British Columbia; in many parts of the province of Quebec it is prevalent, and also in Ontario. Mountainous districts are said to be most liable to it, though some are free. This may be due to the greater vulnerability of the people inhabiting these regions, owing to the greater activity of the thyroid induced by high altitudes. The tendency to goitre is in some degree hereditary, especially if the offspring is subject to the same influences as the parent. This influence operating through generations may induce a form of thyroid which produces an individual of lower resisting power and less intelligence. This tendency is increased by the inter-marriage of goitrous persons.

Goitre is not confined to man, but is common in animals in the localities where man is affected. It occurs in mules, horses, oxen, dogs, cats, pigs, sheep, fowl and pigeons, and even fish are subject to it, especially carnivorous fish, such as pike and carp. In many parts of Europe certain waters are known to produce goitre and, in Germany, it was common for those liable to be conscripted to resort to these springs (*Knopfbrunnen*) in order to induce enlargement of the thyroid and so avoid military service. In most cases the enlargement decreases or disappears on ceasing to drink the waters or removing to a goitre-free district. The prevalence of goitre in some mountainous districts may be due to the fact that there is often very little soil over the rock and that pollutions of the water supply occur by surface drainage into the wells and streams, the soil not being sufficient to absorb and disinfect polluted material, such as excreta from man and animals. McCarrison says that, in India, the affection is more common along rivers and canals. As to the fact that the disease is more commonly associated with limestone formations, while true, other geological formations are also liable. Limestone absorbs more readily, being more porous, besides limestone is more widely distributed than any other geological formation. The ingestion of lime in the water, while not the actual cause of goitre, throws more work on the gland and thus renders it more susceptible to infective influence.

Fig. 6.—A case of Cretinism, due to congenital deficiency of the thyroid gland.

Fig. 7.—A case of ordinary goître, shewing diffuse parenchyonatous enlargement of the gland.

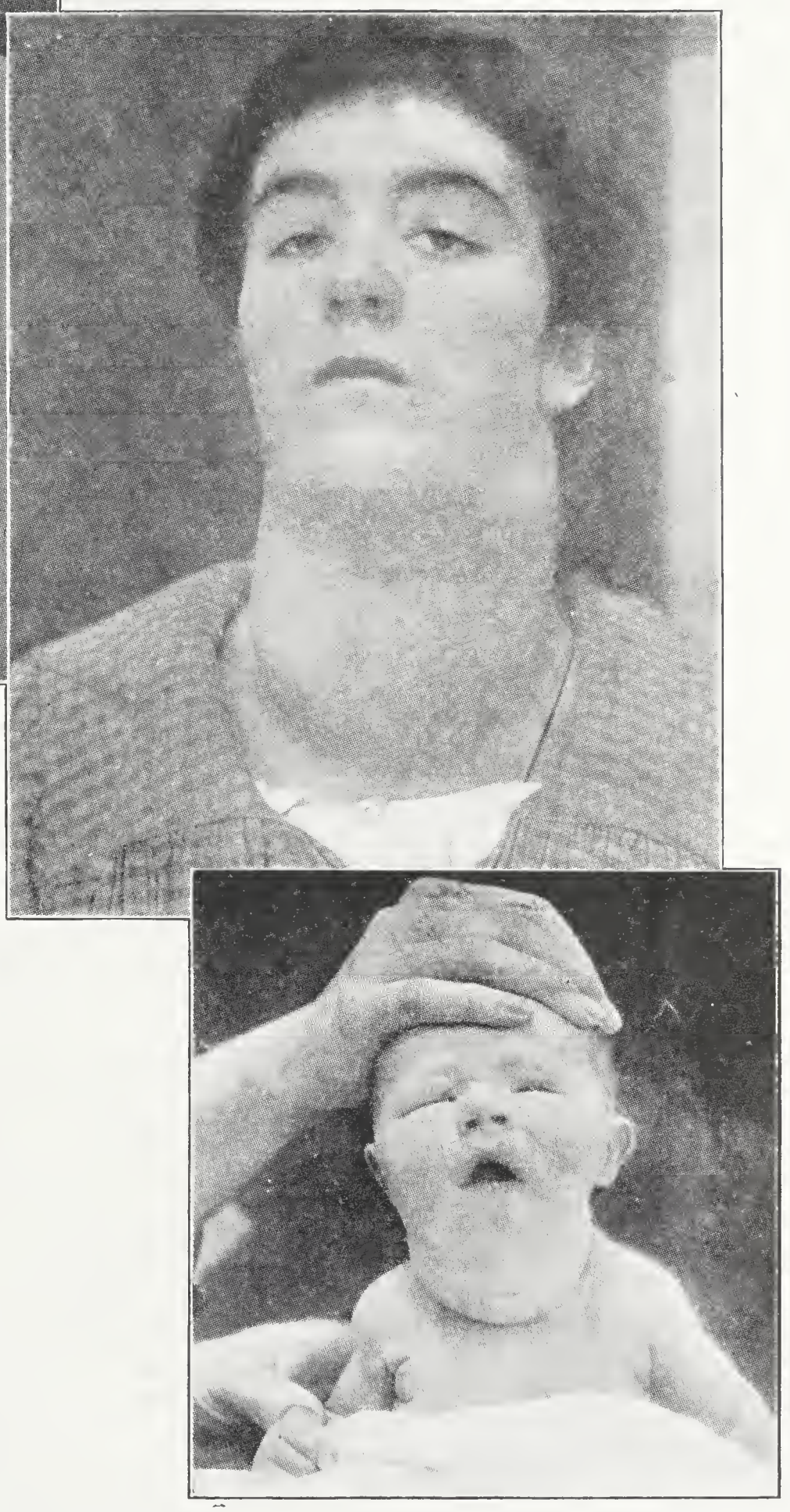

Fig. 8.—Case of goître in a new-born baby.

Goitre is never truly epidemic, but it may be more prevalent at some times than others, as, for example, when there is a large influx of new-comers, such as school children, soldiers, settlers, etc., especially if they are living in badly-ventilated or unhygienic schools or barracks.

Age and Sex

Children are more susceptible than adults, especially if new-comers. The most susceptible ages in children are nine in a boy and ten in a girl; after that the susceptibility diminishes slightly but increases again at puberty. As years go by the susceptibility in males decreases but increases in the female during the child-bearing period of life. It is said that, in ordinary conditions of life, in 50 per cent of pregnant women, the gland enlarges in places where goitre is not endemic.

The Agents which Cause Goitre

It is now the commonly received opinion that the infective cause of goitre is chiefly in the drinking water, which gets infected from soil contaminated by the excreta of man and animals. In this way food may, also, through water and dirt, be a mode of causation. Flies are blamed by some, as they are for most infective diseases. Drinking water, however, is the chief cause. It has been shown that, in districts where goitre abounded, when the water supply was changed and was obtained from a non-goitrous district, the percentage of goitrous children fell from 59 per cent to 11 per cent in ten years. The organism is now believed to be intestinal, probably a form of the *Bacillus Coli*. Goitre has been produced artificially in animals by taking the mud or dirt on the outside of a Berkfeld filter from water in a goitrous district and feeding it to animals. As stated by Lustig and Carle, a horse has acquired goitre by giving it water from an infected well; then, later, when it was given pure water the gland returned to its normal size. McCarrison has produced it experimentally in animals (rats and goats) by feeding them on cultures from the excreta of goitrous and non-goitrous persons. He says: It seems almost certain that the great source of the disease is the infected individual, and that he is the producer, the reservoir, and the distributor or carrier of the infecting agents. These agents are discharged from the body in the fœces, and, it may be, in other ways unknown to us, as, for example, the urine and saliva. If they reach a damp soil containing a high proportion of organic matter they live and, it may be, multiply, while, if they reach an organically impure and stagnant water which is protected from the purifying effect of light and air, as in the case of many wells, they may survive for a considerable time. Goitre is a water-borne disease and, in this respect, resembles typhoid fever.

In some cases of simple goitre the tendency is to recover to normal conditions but, in the majority of cases, the gland remains permanently, though often slightly, enlarged. Symptoms are absent as a rule and the gland functionates normally. In some cases where the enlargement is great the heart may be enlarged, but this is due to mechanical pressure on the blood vessels.

HOW TO KEEP FREE FROM ENLARGED THYROID OR SIMPLE GOITRE

Prophylaxis

First of all, perfect cleanliness and good hygienic surroundings are necessary. As was stated above, food should be carefully protected from infected soils and other materials. As the water is infected from the soil, it is necessary to use pure water. Boiling the water is most important, for in this way the *contagium vivum*, or active organism, is destroyed. For washing purposes the water may be disinfected by the use of chloride of lime or iodine.

The sanitary disposal of sewage is important also. The removal of all manure heaps (which, of course, means the removal of all stables and byres) from the immediate neighbourhood of dwellings is most important; also the doing away with cesspools. In country parts, dry-earth closets are more hygienic, if their contents are afterwards properly disposed of.

These precautions in the localities where goitre exists will all tend to the lessening or abolition of the affection.

Treatment

The way of preventing goitre, or prophylaxis, has already been treated sufficiently in the previous paragraphs. Medicinal treatment is only suitable in the early stages. When goitres get unsightly and, from their size, produce palpitations and difficulty of breathing or swallowing, surgical intervention is the only method of treatment. Perhaps the most efficacious of all remedies in the early treatment of goitre is *iodine*. It is antitoxic and antiseptic, and tends to aid in the reversion of the thyroid to a colloid condition. It may be taken internally in doses of five drops in a little water several times a day, or in combination with potassium iodide and syrup of the iodide of iron. It may also be employed externally as a paint or in the form of the biniodide of mercury ointment of the *British Pharmacopœa*. This must be rubbed in carefully; many advise afterwards exposing the neck to the sun.

It being probable—in fact, almost certain—that the source of infection is intestinal and of microbic origin, intestinal antiseptics are advised. The best of these is *Thymol*, given in five-grain doses morning and evening. *Salol* and *B. Naphthol* are useful also. Some have advised, in combination with these remedies, the use of soured milk prepared from the Bulgarian bacillus. Quinine has been advocated for this as for so many other diseases, including influenza. Vaccines, mixed or special, or anti-vaccines made from the intestinal organisms, have, by some, been found of good effect. Removal to the seashore has proved of benefit to many, but this source of treatment is available only to the well-to-do. As remarked before, as meat furnishes no iodine, if too largely taken, it is a deleterious diet in goitre; vegetables and milk should therefore form a large portion of the diet. X-rays have often been of benefit in the so-called parenchymatous goitres. Thyroid preparations have also proved of benefit in some cases where iodine has failed, because the iodine in the thyroid when taken in this form can be more easily assimilated. In young girls in the early stages of goitre these measures are nearly always efficacious. Attention should always be paid to the bowels; they should never be allowed to become constipated.